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The decisive factors for profitability in direct reuse of polystyrene packaging materials

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This study explores the factors that are decisive for profitability in operating a reverse supply chain (RSC) that reuses polystyrene packaging materials used for transporting temperature sensitive items (within each polystyrene box is a number of cooling elements that keep temperatures steady). The paper uses data from a manufacturer of measurement instruments, who distributes temperature sensitive liquids to its customers. Customers use these liquids during the measurement equipment's operation. Every year the firm sends more than 12.000 shipments to the German market and for each of these shipments the firm purchases a polystyrene box, which the customer disposes of through their waste management process. The study calculates the financial performance of a RSC that takes back all polystyrene boxes for direct reuse. Boxes that are unfit for reuse are discarded at the firm's factory at the firm's cost.

Using the RSC-concept and the business perspective on the RSC formulated by Guide and Van Wassenhove (2002, 2006), and the extension of this perspective by Larsen and Jacobsen (2014, 2015) as theoretical basis, the study first identifies the set of relevant variables for calculating the RSC's financial performance. This is conducted by combining a literature review to identify known variables with the case study described in the previous paragraph to identify any unknown variables. Second, and once the total set of variables is identified, the study calculates the RSC's financial performance. Third, the study assesses the relative impact among the identified variables to identify the most decisive factors. This method, which is novel in the RSC field, is constituted by a sensitivity analysis that determines the decisive factors by changing each variable by +20% while observing the impact on the calculated profitability. Results show that the decisive factors for profitability in polystyrene packaging materials reuse are 1) the avoided costs of purchasing virgin packaging materials, 2) the costs of reverse logistics.

Given that the study's data is limited to only one firm's operation, generalizability may appear limited. However, polystyrene packaging materials are used in many industries for the same purpose and using the same basic processes as this study's case, which strengthens finding's generalizability. In addition, the study provides the basis for future investigations of the bilateral relationships between the identified decisive factors and profitability, and also aid in the search for the decisive factors' sub-level antecedents and mechanisms (e.g. how reduced purchasing volumes of packaging materials impact prices, which impact the amount of avoided costs).

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Poster at conference:

The decisive factors for profitability in direct reuse of polystyrene packaging materials

Samuel Brüning Larsen, PhD-student, DTU Management Engineering
Peter Jacobsen, Associate Professor, DTU Management Engineering

Research question

"What are the decisive factors for profitability for a firm's operation of a reverse supply chain (RSC) that takes back and reuses polystyrene packaging materials*?"

Methodology and empirical approach

Using data from a Danish manufacturer of measurement instruments, the paper first identifies the total set of variables that are relevant for determining the profitability of reusing polystyrene packaging materials, and second assesses the relative impact among the identified factors.

The paper's theoretical basis is the RSC literature's business perspective formulated by Guide and Van Wassenhove.

* Each polystyrene box contains a number of colling elements (plastic boxes)

Case

The case firm ships more than 12.000 packages to the German market each year. Today, the firm purchases packaging materials for all shipments. The paper determines the financial performance of a RSC that takes back materials for reuse. In the take back scenario all materials are assembled in a hub in Hamburg and shipped to Denmark for reuse.



Results

The RSC earns nearly 1 mio. DKK in yearly profits. The drivers of this profitability are:

- 1) The amount of avoided costs of purchasing new packaging materials
- 2) The firm's ability to reduce costs of reverse logistics

In addition, taking back packaging materials relieves customers of handling and disposing materials leading to higher customer satisfaction.

Theoretical and practical relevance

Traditionally and on all continents, RSCs have been viewed as a nuisance or necessary evil. This applies in industry and academia alike. However, the emerging business perspective on the RSC challenges the view and this study contributes to the perspective by reporting on the profitability of the study's case.